BOILER PERFORMANCE TESTING

SCOPE OF WORK:
The Intermountain Power Service Corporation (IPSC) is upgrading plant performance and capacity by replacing the high pressure (HP) turbine, adding additional superheater platen surface area and providing an overfire air system. We will be conducting performance testing on the Boiler following the Intermountain Generating Station (IGS) Unit 1 Major Outage.

The objective of the Boiler Acceptance Testing is to determine boiler effiency, boiler emissions- NOx and CO levels, and fly ash unburned carbon content at main steam and hot reheat temperatures of 1005 F. This information is required to determine Boiler contract penalties and incentives.

Tuning and diagnostics will be accomplished using the combustion gas analyzers, by conducting multipoint gas sampling at the boiler outlet duct to establish NOx, CO, O2 , CO2 & temperature profiles at both 875 MWgross and 950 MWgross load levels. There will be a 64 point grid (32 points of both east and west sides) to determine the degree of gas stratification. Knowing the amount and location of stratification (high and low zones), it can be used as a diagnostics tool to tune burners or overfire dampers to minimize this effect. Typically, extremely high or low values for CO and NOx reflect bad actors (incomplete combustion) which should be tunable. The CO2 and O2 analyzers will be used to determine air flow balancing, plus will be used for boiler efficiency (gas loss method) calculations.

Additionally, the test O2 analyzers will be used to reconcile accuracies with the station O2 analyzers (both test grids are at the same location).

The following test conditions will be determined:

- Main Steam and Hot Reheat temperatures
- Main Steam and Hot Reheat attempering spray flows
- Boiler Section Cleanliness factors
- coal quality (proximate and ultimate analysis)
- fly ash (unburned carbon content)
- bottom and air heater ash (unburned carbon content)
- Boiler Efficiency (heat loss method)

SCOPE OF TESTING:
IPSC will rent third party test gas analyzers, data logger and controller and have a test technician to initially setup and train IPSC personal.

IPSC will setup boiler test equipment, which includes the boiler test probes located at the boiler outlet (16 probes with 4 points each), bubblers, chillers, knockout bottles, desicant filters vacuum pumps, plumbing and fittings.

Coal samples will be taken at each individaul coal feeder plus fly ash, bottom ash and air heater ash samples will be collected and analyzed.

IPSC will conduct the acceptance testing and tuning, provide test setup, provide test procedures, publish test results, recommendations and final report.

TURBINE CYCLE PERFORMANCE TESTING

SCOPE OF WORK:
The Intermountain Power Service Corporation (IPSC) is upgrading plant performance and capacity by replacing the high pressure (HP) turbine section.
We will be conducting performance testing on the HP turbine and turbine cycle following the Intermountain Generating Station (IGS) Unit 1 Major Outages.

The objective of the HP turbine acceptance testing is to determine the HP turbine efficiency (enthalpy drop test) and HP Wheel Power (electrical load equivalent produced by the HP turbine). This information is required to determine HP turbine contract penalties and incentives.

In addition to testing the HP turbine for acceptance, the performance tests will be used for benchmarking the performance of other key turbine cycle components. These include: the IP turbine (following its outage overhaul), retractable steam packing on HP & IP turbine, boiler feedpump volute acceptance (following outage changeout), and boiler feedpump turbines (detailed performance evaluation).

All station instrumentation points will be cross checked and reconciled with third party instrumentation. High accuracy instrumentation is critical to establish several key relationships: 1) HP Turbine Bowl Pressure (1st stage pressure tap replacement) to throttle steam flow used for turbine controls setup, 2) final feedwater flow to throttle flow relationship (used for controls as well as monitoring steam flow for safety valve limitations), 3) generator electrical output.

SCOPE OF TESTING:
IPSC would like an independent third party to provide precision test instrumentation, test equipment, and data acquisition system for the data collection, reduction and calculation of test results. The contractor would provide technical assistance in conducting the tests, reviewing test set-up, evaluating test procedures and cycle isolation lists, providing test results, recommendations and final report.

Technical Support will be provided by IPSC to assist with instrumentation and equipment hookup and teardown, conduct required outage inspections (for flow nozzles (FFW nozzle, SH spray nozzle, BFPT Extraction nozzles (2)), turbine exhaust basket tips, etc.), provide test coordination and direction, provide detailed test procedures, provide marked up P&IDs to identify test points and station instrumentation, plus conduct trubine cycle isolation for each test.

TEST PROCEDURE:
The guideline for the turbine cycle performance test will be ASME PTC 6 - 1996 Alternative Test Method for Steam Turbines, utilizing the high pressure primary feedwater flow element and as otherwise stated in the IPSC turbine performance test specifications. A detailed Test Procedure will be provided by IPSC.

SCHEDULE SUMMARY: IGS Unit 1

Performance Testing	April 14 - 18, 2003
Test Set-up during Unit 2 shutdown	March 31 - April 13, 2003
HP Turbine Enthalpy Drop - 30 day followup*	May 6 - 8, 2003

(*HP Turbine contractual requirement only if station instrumentation indicates a significant drop in performance.)

TEST SERIES (6):
Full Load Tests (2) @ VWO/ 2400 psig/Load 975 MWg
96% Load Tests (1) @ VWO/ 2300 psig/Load 930 MWg
92% Load Tests (1) @ VWO/ 2200 psig/Load 890 MWg
87% Load Tests (1) @ VWO/ 2100 psig/Load 850 MWg
95% Load Test (1) throttle controlled/~2300 psig/Load 925 MWg

Boiler Testing Schedule IGS Unit 1

IGS Unit 1 Pre-Outage Baseline Testing
2/19-20/03 (test setup 2/13-18/2003)
establish baseline conditions for CO, NOx, O2 at boiler outlet

IGS Unit 1 Post-Outage Baseline Testing
April 1st week (unit startup) burner turndowns
It is imperative on unit startup to tune the burners and overfire air system to get good flame profiles that the scanners will recognize.
Test Set-up during last week of Unit 2 shutdown (3/24-31/03)

April 2nd and 3rd weeks- Tuning and diagnostic testing

Boiler Performance Testing as required by IPSC for the Intermountain Generating Station Units 1 and 2.

a. Plant Description: INTERMOUNTAIN GENERATING STATION
Two sister 875 MW gross units
IGS Unit 1 commercial 6/86
IGS Unit 2 commercial 5/87

b. Turbine Design Information: General Electric S-2, tandem-compound, single reheat with six-flow low pressure stages. The turbine consists of:

HP Turbine: newly replaced (U2 - 03/2002, U1 - 03/2003) Alstom single flow,with full arc admission
IP Turbine: double flow reheat
LP Turbines: Three (3) double flow low pressure sections with 30-inch last stage buckets

Rated Operating Conditions:
VWO/2400psig/1000F/1000F/6,900 kpph/977 MW gross
Variable Back pressure of 1.66" Hga/2.24" Hga/2.99" Hga

Stop Valves (4)
Control Valves (4) full arc admission control
Combine reheat stop and intercept valves (2)
Each SV and RSIV have associated steam strainers

Condensers: Three (3) Variable Pressure Condenser Hoods
Feedwater Heaters: Dual string of three (3) high pressure FW heaters (8A/8B, 7A/7B, & 6A/6B)
LP FW Heater String (deaerator, 4, 3, 2, 1A/1B/1C, DC)

Pumps/BFPT: Two (2) Boiler Feed Pumps, two (2) Boiler Feed Pump Turbines, three (3) Booster Boiler Feed Pumps, three (3) Condensate Pumps

TURBINE CYCLE PERFORMANCE TESTING- TURBINE DESIGN INFORMATION

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INTERMOUNTAIN GENERATING STATION
Two sister 875 MW gross units
IGS Unit 1 went commercial 6/86, IGS Unit 2 went commercial 5/87

TURBINE ORIGINAL DESIGN INFO
General Electric S-2, tandem-compound, single reheat with six-flow low pressure stages. Turbine consists of:
HP Turbine - newly replaced Allstom single flow, full arc admission
IP Turbine - double flow reheat
LP Turbines - 3 double flow low pressure sections

Stop Valves (4)

Control Valves (4) new full arc admission, via valve chest
combine reheat stop and intercept valves (2)

Condensers
3 Variable Pressure Condenser Hoods

Feedwater Heaters
Dual string of 3 high pressure feedwater heaters (8A/8B, 7A/7B, & 6A/6B)
LP FW Heater String (deaerator, 4, 3, 2, 1A/1B/1C, DC)

Pumps/BFPT
2 Boiler Feed Pump
2 Boiler Feed Pump Turbines
3 Booster Boiler Feed Pumps
3 Condensate Pumps